

TITLE: Rhinoplasty and the Nasal Valve

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Nasal obstruction is a common complaint for patients that present to otolaryngologists. The differential diagnosis includes both physiologic and anatomic etiologies. Mucosal diseases like allergic rhinitis and vasomotor rhinitis need to be optimally treated medically. Anatomic variations attribute to nasal obstruction and include both the cartilaginous and bony portions of the nasal skeleton.

Pre operative assessment of patients with nasal obstruction should be thorough. The external appearance should be scrutinized. A detailed intranasal exam with and without decongestion should be performed using anterior rhinoscopy and nasal endoscopy when warranted. A symptom score index is useful for the patients to fill out so that pre and post therapy results can be tabulated. The Cottle maneuver is useful in identifying nasal valve obstructions but the modified Cottle maneuver is better at identifying the level of obstruction. Also patients need to be observed during normal and exaggerated nasal breathing because normal nasal valve collapse occurs during exaggerated respirations. The basic physics behind airway collapse are based on Poiseuille's law and Bernoulli's principle. Poiseuille's law states that fluid flow and resistance is related to the fourth power of the radius. Bernoulli's principle involves the changes in internal and external luminal pressure as it relates to fluid velocity. As fluid travels through a smaller space, velocity must increase, thereby decreasing the internal pressure which makes it more apt to collapse.

The anatomy of the nasal valve was first described by Mink in 1903. This site has the highest level of nasal resistance because it is the narrowest portion of the nasal cavity. The nasal valve complex is bordered superiorly by the caudal end of the upper lateral cartilages and septum. Posteriorly the nasal valve complex is bordered by the inferior turbinate. The inferior border is the nasal floor and the lateral border is the bony piriform aperture and adjacent fibrofatty tissue. The normal cross sectional area of the nasal valve complex is 55 to 83 mm². The nasal valve complex can be split into the internal nasal valve area and external nasal valve. The internal nasal valve area borders are the septum, piriform aperture floor, head of the inferior turbinate and the caudal border of the upper lateral cartilage. The internal nasal valve (INV) is a specific structure within the internal nasal valve area. It is found between the caudal border of the upper lateral cartilage and septum. In leptorhine noses the angle of the INV is 10-15 degrees.

Patients with angles less than ten degrees typically have nasal obstructive symptoms. Murat et al updated the classic description of the INV by using endoscopic photodocumentation. They found six common subtypes: convex caudal border type, angle occupied by septal body, twisted caudal border, sharp angle, blunt angle and concave caudal border types. The sharp angle and convex caudal border types are the most like the classically described INV described by Mink. The study found that the angle occupied by the septal body was the most common subtype and that patients were not likely to have the same subtype in both nasal cavities. The external nasal valve is formed by the nasal vestibule caudal to the INV. The fibrofatty alar and lower lateral cartilage tissues make up the lateral and anterior borders along with the caudal septum and piriform aperture.

The most common cause of INV stenosis is deviated septum. The most commonly performed procedure to correct this problem is septoplasty with turbinate reduction. Turbinate hypertrophy can contribute to INV stenosis. This can be addressed using nasal sprays and oral antihistamines. The most common surgical procedure to correct turbinate hypertrophy is submucous resection. Studies have shown that the minimal cross sectional area at the INV decreases after reduction rhinoplasties are performed. Over 90% of post op nasal obstruction is not due to the septal cartilage. Up to 64% of post op nasal obstruction is found at the internal valve and up to 50% is found at the external valve. Patients at risk for post op stenosis have high, narrow dorsums with a weak middle vault. This is found in patients with long noses and short nasal bones and thin skin. Patients that have a positive Cottle maneuver pre operatively are also at risk for post op stenosis.

The most common surgical procedure used to address INV stenosis is spreader graft implantation. This was originally described by Sheen in 1984 and has been used for both functional and cosmetic procedures. Spreader graft placement corrects the lack of dorsal support and helps restore a normal dorsal profile. The grafts can be placed via an open or closed approach. Cartilage is typically harvested from the septum and carved into 1-2 mm thick matchsticks that extend the entire length of the upper lateral cartilage. A submucosal pocket is created between the septum and the upper lateral cartilage. The grafts are sutured in place using horizontal mattress that goes through both upper lateral cartilages, grafts and the septum. Care should be taken to not pass through the underlying nasal mucosa since this could narrow the INV angle. Scuito et al widens the INV by placing traditional spreader grafts and then suspends the upper lateral cartilages over the grafts, which further effaces the INV angle.

Andre et al described endonasal placement of spreader grafts in 89 patients. They evaluated three different fixation techniques and found that creation of a “tight fitting tunnel” had the greatest post op improvement. Endoscopic placement of spreader grafts in cadavers was described Huang et al. A 30 degree rigid nasal scope was placed into a submucoperichondrial flap. The fibrous junction between the upper lateral cartilage and the septum was separated using a freer elevator then the grafts were placed. Acoustic rhinometry confirmed that graft placement increased the INV cross sectional area.

A variation of the spreader graft used for very crooked noses is the septal cross bar described by Bocchieri. A septal graft is taken and a tab is made in the dorsal septum. The rigid graft is placed so that it corrects the curve and also acts as a spreader graft on the side it is placed.

The conchal butterfly graft described by Clark et al uses conchal cartilage placed via a closed approach to increase the angle of the INV. The graft uses the natural shape of the conchal graft to lend support to the weaker upper lateral cartilages. The graft is placed through intercartilagenous and full transfixion incisions. The dorsal septum and dorsal portion of the graft are trimmed in order to prevent polly beak deformities post op.

Sen et al described a spring graft which utilizes resected alar cartilage to increase the INV. The resected cartilages are sewn together to increase their strength. Then they are placed deep to the upper lateral cartilage so that the natural curve of the grafts are used to pull the upper laterals outward.

Schlosser et al describe the use of flaring sutures to increase the INV in a Cadaveric study. Placed through an open approach, a horizontal mattress suture is passed through the lateral portions of the upper lateral cartilage over the dorsum to the lateral portion of the contralateral upper lateral cartilage and back. The suture is tightened and fulcrums on the dorsum, pulling the lateral borders outward and increasing the area of the valve. The best post operative improvements in cross sectional area were seen when spreader grafts and flaring sutures were used in combination.

Mini spreader grafts are described by Boccieri. He utilizes resected alar cartilage from a cephalic trim to create the graft. The resected portions are kept attached medially and are then placed between the upper laterals and the septum. The fixation of the grafts also enables concurrent elevation of the nasal tip since the grafts are pedicled to the alar cartilage.

Byrd et al described the autospreader flap. This graft uses “normally resected” portions of the upper lateral cartilages in reduction rhinoplasty. Instead of tossing the cartilage, the underlying perichondrium is kept intact and the grafts are rotated internally between the septum and medial edge of the upper lateral cartilage. The technique is useful in patients with long thin noses that are straight. Placement of the grafts for these patients decreases the likelihood of post operative INV stenosis. This technique is not adequate for patients with deviated dorsums because the upper lateral cartilage grafts are not strong enough to straighten the septum.

Resorbable spreader grafts are used when no other autologous tissue can be used. Stal et al describe the use of Lactosorb, a polylactic and polyglycolic acid polymer, in pediatric revision rhinoplasty patients. Lactosorb takes 12 months to absorb which is thought to be enough time for the nasal skeleton to stabilize. When the paper was published in 2000, follow up ranged from 12-18 months with no airway obstruction relapses or post operative complications. Gurlek describes the use of polyethylene spreader grafts in revision rhinoplasty cases. He used these grafts in 15 patient, followed them for a mean of 16 months and reported no complications or recurrence of airway obstruction.

Nyte has presented case reports of injectable spreader grafts placed in patients that did not desire surgical intervention. He reported the use of both Radiesse (calcium hydroxylapatite) and Restylane (hyaluronic acid). He reports that patient have good initial results but long term follow up was not reported.

Capone et al described the effect that deep plane rhytidectomy has on the nasal valve. Mid facial deep plane lifts mimic the action of the Cottle maneuver. He evaluated 20 patients with pre and post op acoustic rhinometry and found that the INV cross sectional area increases 22% but does decrease over time. The external nasal valve increases an average of 5%. Overall 70% of patients reported improvement on nasal patency scores following rhytidectomy.

Stewart et al developed a disease specific validated quality of life scale in order to assess the outcomes of septoplasty for nasal obstruction. The nasal obstructive symptom evaluation (NOSE) scale asks patients to assess the severity of nasal congestion or stuffiness, nasal blockage or obstruction, trouble with nasal breathing, and the ability to get enough air nasally during strenuous activities. 59 patients were assessed at multiple centers and were evaluated preoperatively, 3 months post op and 6 months post op. Patients underwent septoplasty with or without turbinate reduction. The results show that patient satisfaction is very high following surgery and that mean NOSE scores decreased from 67.5 to 23.1 post operatively. Another interesting finding was that patients were able to decrease the amount of oral decongestants and nasal steroids following surgery.

Rhee et al used NOSE scores to evaluate the effect that functional septorhinoplasty had on patients. In addition to septoplasty and turbinoplasty, these patients had nasal tip work, spreader grafts placed, and osteotomies. 26 patients were evaluated and 75% of patients were very happy 6 months post operatively. In contrast to Stewart et al's findings, these patients were not able to decrease the amount of nasal medications they had to take. Dr Most performed a similar study and found that mean NOSE scores decreased from 58.3 to 15.7 following functional septorhinoplasty.

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